Composition of the Final Sample of DONuT

Abstract: The interaction type identified in the analysis of the final sample of 553 events is given.

Introduction

The event type recognized from the analysis is a distorted representation of the Monte Carlo and physical expectation. The physical types are CC ν_μ (prompt), CC ν_μ (non-prompt), CC ν_e, CC ν_τ, and NC. The types recognized by the analysis are CC ν_μ, CC ν_e, CC ν_τ and NC-like.

Analysis

The computation of the event types depends only on the relative values of the efficiencies, production and interaction of each physical type. In this analysis, we set the prompt flux of ν_e and ν_μ equal to 1. The rest follow by computation: (1) non-prompt ν_μ's are 0.8 , (2) the ν_τ's are the relative production fraction times the average of the kinematic factor for the interacted flux, and (3) the NC events are 0.34 times the sum of the CC fraction. These values are found in row 1 of Table 2.

The values are normalized in row 2 and multiplied by total selection efficiencies to get row 6. Note that the NC fraction of row 6 includes the "feed-through" fraction, i.e. those CC*e*, CCμ and CCτ events not identified as such. They become "NC-like" events. There may be a fraction of CCμ events that feed-through to CC*e*, but this is not estimated here.

	CCμ	CC*e*	CCτ	NC
Trig/Scan	0.63	0.64	0.63	0.56
Decay ε	1.0	1.0	0.62	1.0
Π	0.63	0.64	0.39	0.56
Accept.	0.74	0.90	1.0	1.0
Π	0.47	0.58	0.39	0.56

Table 1. Efficiencies relevant to composition analysis. The lepton acceptances are also given. For τ's all physical and analytical acceptances are given in the decay efficiency term.

Row 7 contains the normalized (again) results of the efficiency/feed-through of the events, and represents the final fraction of each type recognized by the analysis. One can compare the numbers of events by multiplying by the total number of events used the analysis. This is given as 553 events. The most significant deviation is in the "NC-like" type which is 1.44 standard deviations low compared to the estimate.

	CC*e*	CCμ prompt	CCμ non-prmt	CCτ	NC	Σ
1 "physics"	1.0	1.0	0.8	0.16×0.67= 0.107	2.91×0.349=1.014	3.92
2 (1) normalized	0.255	0.255	0.204	0.027	0.259	1.00
3 efficiencies	0.63	0.64	0.64	0.39	0.56	
4 acceptance	0.90	0.74	0.74	1.0	0.87	
5 feed-through	0.1	0.26	0.26	0.61	0	
6 (2)×(3)×(4)	0.145	0.121	0.097	0.011	0.232	0.608
7 (6) normalized	0.238	0.199	0.159	0.018	0.382	0.999
8 N=553×(7)	132	110	88	10	212	552
9 Measured	143	210		9	191	553
10 Difference	11	12		-1	-21	

Table 2. The composition is computed by this table used like a spreadsheet. The following values are used:

1) in row 1, the CCτ input is computed from E. Maher thesis Eq. 6.22 and 6.23 for the ratio of ν_τ to ν_e production [0.16] and p.150 of R. Schwienhorst thesis for the net kinematic reduction of the cross section [0.67].

2) in row 1, the NC input is given as the average of neutrion and anti-neutrino NC to CC ratio [0.349] times the CC input.

3) in row 3, the CCτ efficiency is from Table 6.3 in E. Maher's thesis.

4) row 5 gives the "feed-through" of CC to NC for those located events where the lepton is not identified. It multiplies the corresponding value in row 2 and the result for each CC type is summed and included as NC-like.